—The increase in the use of email in every day transactions for a lot of businesses or general communication due to its cost effectiveness and efficiency has made emails vulnerable to attacks including spamming. Spam emails also called junk emails are unsolicited messages that are almost identical and sent to multiple recipients randomly. In this study, a performance analysis is done on some classification algorithms including: Bayesian Logistic Regression, Hidden Naïve Bayes, Radial Basis Function (RBF) Network, Voted Perceptron, Lazy Bayesian Rule, Logit Boost, Rotation Forest, NNge, Logistic Model Tree, REP Tree, Naïve Bayes, Multilayer Perceptron, Random Tree and J48. The performance of the algorithms were measured in terms of Accuracy, Precision, Recall, F Measure, Root Mean Squared Error, Receiver Operator Characteristics Area and Root Relative Squared Error using WEKA data mining tool. To have a balanced view on the classification algorithms' performance, no feature selection or performance boosting method was employed. The research showed that a number of classification algorithms exist that if properly explored through feature selection means will yield more accurate results for email classification. Rotation Forest is found to be the classifier that gives the best accuracy of 94.2%. Though none of the algorithms did not achieve 100% accuracy in sorting spam emails, Rotation Forest has shown a near degree to achieving most accurate result